

The Big Switch with Saul Griffith

Dr Saul Griffith
Founder of Rewiring Australia

Dan Cass

Energy policy and regulatory lead, The Australia Institute

In conversation with

Ebony Bennett
Deputy Director at the Australia Institute

Ebony Bennett [00:00:03] G'day everyone, I'm Ebony Bennett, deputy director at the Australia Institute and welcome to our 2022 webinar series. I'd like to begin by acknowledging that I live and work on Ngunnawal and Ngambri country and pay my respects to elders past and present. Sovereignty was never ceded, and it always was and always will be Aboriginal land. We do webinars at least weekly about the dates and times do vary. So head on over to Australia Institute dot org dot a--you to find all our upcoming events so you don't miss out. And just a few tips about Zoom before we begin to help things run smoothly. First of all, if you hover over the bottom of your screen, you should be able to see a little Q&A box where you can type in questions for our panel. You should also be able to upvote interesting questions from other people. A reminder to please keep things civil and on topic in the chat or will boot you out. And a reminder that this discussion is being recorded and will go up on our website and at Australian Institute Dot TV later this afternoon. Well, if you follow climate news as closely as we do here at the Australia Institute, you may have seen that last week, governments and the public alike were taken by surprise when Origin Energy announced that it would be closing Australia's largest coal fired power station by 2025. And this news was followed by AGL earlier announcement that it would be closing two of its coal fired power stations early then to add to the drama. Just a few days later, Mike Cannon-Brookes made a bid to take over AGL Energy with a view to phasing out coal assets by 2030. And these events all make it very clear that coal is on the way out in Australia. The question is really no longer if coal is phased out, but when and how, and equally importantly, what comes after that transition. So our guest today has that answer. And we know you are all interested out there because almost 2000 people have registered for today's event. So welcome and thanks for joining us. We are absolutely delighted to be joined by energy expert and author Saul Griffith, who in his new book *The Big Switch*, which I've got a copy of here published by Black Inc and available at all good bookshops at the moment, sets out an achievable and equitable road map for dramatically cutting Australia's emissions using proven technologies available right now. Electric cars, electric kitchen ranges, water heaters and heating systems by 2030, Saul says Australia's households could be saving up to \$65 billion a year equivalent to our

export earnings from coal. And joining us for today is Dan Cass, energy policy and regulatory lead at the Australia Institute. Good day Saul and Dan, thanks so much for joining us.

Saul Griffith [00:02:42] Thank you for having me.

Ebony Bennett [00:02:44] Saul first of all, tell us about why you decided now is the time to write this book.

Saul Griffith [00:02:54] I genuinely believe that Australia can lead, and in fact, the world now needs Australia to lead. I wrote a book 18 months ago called *Electrify* that was very much a book written with an audience of one in mind, meaning the incoming American president. We didn't know who it was when I wrote it. The goal being and the hope being that America would. The new president would essentially be Franklin D. Roosevelt in America, would lead the world with very, very bold climate action. I think. It was a detailed argument for why really, there's only one solution for the majority of our emissions. That said, electrification, it was meant to be a crisp argument. And that's true of the book for Australia the big switch of crisp argument so that we stop being distracted by the false solutions, the hydrogens, the carbon capturing the, et cetera. You know, we need a little bit of everything, but we need the huge amount of electrification anyway. Given the struggle of American politics, I think if you're your hope is for Joe Biden to become Franklin D. Roosevelt, you need to be a little less optimistic. And if you're thinking about the highest leverage point in the global conversation on climate and this is an extraordinary thing to say, Australia is the place where the economics are working. First are going to work enormously well in the very, very near future, and we can provide the template for how the world gets rid of the majority of its emissions. So the book was very much the concise argument to try and bring forward that moment for Australia in Australia as soon as possible, which means to begin disposing with the bad arguments for other things and providing the economic and technical arguments that support widespread electrification as the as our answer.

Ebony Bennett [00:04:53] Yeah, I mean, congratulations on the book. I've been powering through it. And it's I mean, it's a cracking read. You've got such a way with description of people. I'm going to come to that a bit later. But the thing I was just struck by reading it is I was so hopeful reading the book. I feel like, particularly in Australian politics, what we ever hear about is it's too hard. It's too expensive. Kind of. We can't do it. It's all extremely negative, but you just so clearly lay out that it's actually just this massive opportunity. How important is that kind of positive message that actually there's so much that we could we could benefit from this.

Saul Griffith [00:05:32] I think it's critical, and I'm shamelessly pushing that optimistic message. I think it's critical because the culture wars fought on a battlefield that honestly has 1970s as its origins. The environmentalist movement was born during an energy crisis. The answer to that energy crisis was efficiency, and efficiency means smaller cars, smaller homes, colder homes. That was the

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technical answer to the 1970s environmental crisis energy crisis. But that's not the answer to the current climate crisis. Because you can't efficiency your way to zero emissions, you can't have none of anything. That's what efficiency gets to you. It also means that the argument is poor because it rhymes to the general populace as as less colder. Or, you know, as you might paraphrase the traditional environmentalist argument. If we keep on sacrificing a whole lot, we might be just a little bit less fucked. And when we really needed an argument that like, you know, actually, I'm starting to call it the abundance agenda, which is to shamelessly steal a line from a journalist who I've been talking to. And I think that's right. We actually can. You know, we've been struggling to think about what getting to 100, you know, getting to zero emissions, getting to 100 per cent looks like. But actually, the giant mental cognitive release is, let's imagine going beyond 100 per cent. And let's imagine abundance is actually part of the solution to truly enough abundant sunshine, enough abundant batteries, enough abundant electric vehicles that that we really do it. Once you get to that place, you can release the optimism and you can actually see that we can take the culture more full on. It's not about losing your weekend, it's having an electric jet ski that can provide resiliency to your house. Right? The electric barbecue that does grid services that fries your snacks for free and doesn't taste like gas. We, we have we really do. And particularly in Australia, because of our natural blessings and that the lucky country narrative, we have the opportunity to be the first on that abundance agenda.

Ebony Bennett [00:07:51] I want to come back to some of those opportunities in the future, but just to stick with kind of where we get stuck in the debate at the moment, then I think you were going to ask something about hydrogen there.

Dan Cass [00:08:02] Yeah. Look, I love the chapter in the book, so where you talk about and the way you talk about the false solutions, we've had a lot of hype about hydrogen and you make the point that if we use it instead of batteries would need to build two to three times as many wind turbines and solar panels. It's not a bad thing because when to abundance we hear you. But there's clearly a fundamental problem with hydrogen. What is that problem? And just as the supplementary, why are we hearing so much hype about it if it's really not so good?

Saul Griffith [00:08:36] Well, which one do you want, do you want the history of the hype answer or do you want the why isn't it a good idea?

Dan Cass [00:08:42] Yeah, why doesn't it work?

Saul Griffith [00:08:44] So the why doesn't it work? I'm not saying there will be no hydrogen in the future, but let's say the International Energy Agency, in their modelling, assumes that 50 per cent of the world's energy will be hydrogen in 2050. I just need to. Somebody needs to say that cannot happen and won't happen before we spend too much money. So it might be a few per cent, but not 50. Here's the reason why hydrogen is not an energy source. It's a battery. The only really viable

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hydrogen at scale is green hydrogen and green hydrogen starts with electricity anyway. So if we're going to drive an electric car, for example, we start with one unit of electricity gets stored in the battery you lose a couple of cent goes into the motor, it loses about five percent. And so, you know, 85 90 per cent of that one unit of electricity drives the car. If you go take that electricity and you make hydrogen, you lose 25 per cent or more. Most likely more generating the hydrogen through electrolysis. Then you lose another 10 to 15 per cent when you compress the hydrogen down so that it has enough energy density to be stored in the car. Then you either have to burn it in the car engine or run it through a fuel cell, which is going to lose another 50 per cent of the energy. All told, that means, you know, you're going to get 30 or 40 per cent of that original electricity out, not 90 per cent as you do with the electric car that before you even consider the cost of the tank, the fuel cell, the compressors, the electrolysis means that the cost of driving that vehicle will be two to three times the cost of driving an electric vehicle. So you sort of fail on a technical argument, you fail on an economic argument. Now you could go through the other uses. What about for heat? What about for various things? And most of them end up with a like? It's a thermodynamic story that looks that bad or worse, which then you might say, Well, what might we use it for? Absolutely. We need it for agriculture for in the form of ammonia. That's about one per cent of the world's energy today. Maybe we need it for steel. That's another half of one per cent of the world's energy today. So you start to see that it's looking like a two to five per cent component of the future, not a 50 per cent component. And that has an enormous impact on how you would allocate precious resources in addressing climate risks.

Ebony Bennett [00:11:11] And so I want to come to the chapter that you had on energy and that transition that we're looking at. Talk to me about all the interesting info that's in that chapter because I found it actually really easy to follow. But you know, there's there's a big path ahead. But how does Australia use its energy and what does that transition look like?

Saul Griffith [00:11:37] So the book really tries to separate out our domestic economy. That's the energy we use for things we do at home versus our exports economy, which is the energy we use to make food, to make fuel, to make exports for other countries. That's so that we can understand the two different ways that Australia wins in this energy transition and the two different timeframes upon which we we win. So the domestic economy is mostly driving cars, heating buildings and, you know, including cooking. And in fact, you know, 42 per cent of our domestic emissions are what happens inside households. The choice of fuels we use for our cars. The choice of what we cook with the choice of what we heat our water with and the choice of what we heat the house with. If you include the commercial sector, which is basically small businesses and offices, they are mostly the same types of loads, what those businesses drive, what those businesses heat, the space with what they cook with. And order that takes it to 65 per cent of our domestic emissions are just in those things. Now the solutions for all of those emissions now exist and are getting to the scale and cost where there's no excuse not to do it. So that's electric vehicles, that's induction and electric cooking. That's heat pumps for hot water, that's heat pumps for space heat. And we now have the cheapest electricity in the world because of this dry and rooftop solar miracle. Batteries are finally getting to the cost where they absolutely make sense to harden that solar. And you can see the pretty simple sort of five step plan or six or seven step plan to electrify and decarbonise the domestic economy.

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You can model that you can look at how much we save. We should be able to do all of that by 2030 or 2035. By the time we get there, let's take the household example they spend \$4800 currently on fuels. They spend quite a lot of their money on vehicles. Electric vehicles is shortly, probably off to 2025, going to be cheaper than petrol vehicles. And if we assume that we'll do half the energy off our rooftops, which is reasonable quarter to a half and the rest from the grid, which is powered by wind and solar, then in fact, the cost of energy for that house is going to go down to about six seven hundred dollars a year. And because the vehicle is also cheaper and that that's where these amazing facts that we're going to save four and a half to \$5000 a year in every Australian home by 2030 comes from. That's where you're 40 to \$60 billion in savings in the domestic economy comes from. It is true that in 2022, you need to be a wealthy household to be able to afford all of those toys, but that is going to be increasingly less true by 2024 2025. It won't be true at all. And if indeed, we hire politicians to look just a little bit into the future and try to make the lives best for the Australian people, then it is seemingly insane that we don't have all the major parties and all the minor parties in this country competing for how quickly they can get the Australian public to this. This great outcome that not only addresses climate but really affects what a lot of voters care about, which is their hip pocket.

Ebony Bennett [00:15:05] Yeah. So just to repeat that, that's up to \$5000 a year in savings per household. Once we electrify everything, that's certainly huge figures. But talking about the electricity market, then I wanted to ask you, you've participated in the work of the Energy Security Board to design a new electricity market. Is the market ready for Saul's vision here?

Dan Cass [00:15:31] No, in a word, the market is is stuck in the 90s and in 1992, the first

Saul Griffith [00:15:38] wait is that the 1890s or the 1990s

Dan Cass [00:15:42] and boom, so. So you know, I mean, look, I've been watching Seinfeld, so I can't preach. But back in 1992, there was the first great design paper published for the the what would become the national electricity market. And it said that the the demand side should have equal opportunity. It's very, very 90s phrase did have equal opportunity with generation. And the vision then was engineering vision around the world. Not just here was there were two things going on as a big transmission network in the middle. Two things going on on that are big generators, centralised nuclear in France and coal and hydro here, and some gas speakers. But that's all part of the same story. And then everyone else is just a passive consumer, whether it's a household or a smelter or a hospital and everything in between. And even then, when the economists were designing this market, they said the demand side should be able to participate. So and back then, it was pretty simple. I mean, I'm, you know, a nineties guy. So I have my own little app that tells you when the price is going up and sometimes the electricity price that we all ultimately pay because we pay it at an average cost for the price for the year, the price can go up tenfold or even a hundredfold in the wholesale market. And so I, because I'm interested going, turned some things off. And you know, the that the prices at the end of the month, the company rebates people who participate in this very

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primitive kind of demand side response. You get a rebate of 20 or 30 dollars a month. Now that's that 90s down talking consoles, no 90s guy. And the new electrification version of this is that on absolute steroids. So if we build out what sold is putting forward in his book and we invest consistently in electrification of households. So pulling out the gas, putting in the heat pumps that are incredibly efficient for heating the water and heating the space. The induction cooktop. A lot of supersized solar on the roof. And a heap of batteries in the garage. And then some smart electricians that connected all together. The household is then a producer and a store, as well as being a consumer of energy. And frankly, that could be why big energy doesn't like this. It's not just that I like polluting. They just don't want the competition. So the market has hundreds of barriers. I would say to this kind of participation standards, the rules, the market design itself. And, you know, viewers who follow the Australia Institute will know we put forward a rule change that was finally passed into law last year. The Energy Market Commission. So the big producers now can participate in an equal way, in equal opportunity, in what's called a wholesale demand response mechanism. So when the price goes up a hundredfold, someone who owns a smelter can say, Well, I don't want to smell it at that price, I'm happy to turn off a little bit. And here's the really cool thing. When they do that and they lower demand supply and demand move and readjust, the price lowers. The smelter saves a lot of money, but every consumer who's buying energy at that time saves money when the wholesale price goes down. So demand response is not just amazing for the environment and this whole electrification vision amazing for the consumers who do it. But as the consumers start doing this, everyone benefits from a better life balance on the grid.

Saul Griffith [00:19:07] Here's something that I think the market design is. Honestly, we're too lazy to do the homework, right? So you get to the we're going to electrify everything. Let's talk about this in terms of a household. Today, the average Australian household uses 13 to 14 kilowatt hours of electricity today. The current Australian household uses close to 100 kilowatt hours of all forms of energy, including the energy lost on the grid, generating that 13 kilowatt hours, including the energy in the petrol. The energy and the natural gas. If you electrify all of the end users, the heat, the kitchen, the cars, that household will need 35 kilowatt hours per day in the future, more than doubling close to tripling. The total amount of electricity is going to the electricity market has to grow enormously. The good news is the total amount of energy used by the household goes down enormously. This is the unsung hero story from 100 kilowatt hours a day to 35. That is just the brutal argument for the efficiency of electricity for all of these demand side things that the human behaviours, the household behaviours that we enjoy. Electricity is the best answer for absolutely nearly everything.

Ebony Bennett [00:20:31] So we do a lot of work here at the Australia Institute around coal mining in particular, and we've advocated very heavily for a moratorium on new coal mines to tackle the supply side of things in that respect. And certainly, that's one of the elements of this debate that makes people panic. This idea that we're quite reliant on mineral exports and things and what are we going to have to replace that? You've got a chapter that looks at the opportunities for exports and how we could be getting a lot more value, for example, out of our iron ore exports. What does that look like for our future?

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Saul Griffith [00:21:08] A huge amount of these where Australian politics and the culture war on energy is around what we have to lose and the larger arguments about what we have to lose or we're going to lose our export money, we export 60 odd billion in coal, another 20 odd billion in LNG. It's about \$80 billion, but no one ever tells you about what we import. We heard about import about \$30 billion in oil. And when you import something, you pay the full price. It's \$30 billion that goes away from our country. When you export something, you only make the margin. These are not high margin products, they global commodities. So it is very likely that Australia doesn't make positive money. It loses money on the balance of of imports and exports. In that sense, the end. So you know, what's a better version of the story for what we replace that already bad story isn't it turns out that it can be astounding. Our other major export is iron ore to we just ship red dirt. Then we other people in other countries turn that into steel. I come from a steel background. My first job was in a rolling mill in Newcastle. Turns out that third, as much as a half of the cost of steel is the energy cost that goes into it. Australia, because of our profoundly good renewable resources, will have the cheapest industrial wind and industrial solar in the world if we use that energy to convert. Our iron ore into at least pig iron ore, maybe steel domestically, we enormously increased the value just on the naive version of this, where you convert all hundred megatons of iron ore that we export into steel and then export is steel. That would be an \$800 billion industry, 10 times our current exports in fossil fuels. So when Australia becomes the renewable energy superpower, that is a great title that people have invented for what we could be. It's much less likely that we're exporting 700 per cent in energy. We will be exporting it embodied in green metals. What does Australia have that the world needs? We know what the world will need for this transition. It needs steel for the wind turbines, it needs aluminium for the wind turbine, other pieces of the turbine and for the fracking and the components for the solar modules. It needs copper. It needs lithium, it needs silica and silicon. It needs all these things that Australia is the first, second, third or fourth largest producer and largest reserves in the world at so the opportunity. So this decade we win saving money in our households. Not all of the technologies required to make that export vision come true are yet at scale, but they're all in prototype form or somewhere around the world. So what Australia has to win next decade is using our abundant, cheap electricity to make the green metals that the world needs for this transition. And just to put an emphasis and a point on it, why you would you make three standard three times more expensive energy in the form of hydrogen to Japan or China? To convert our iron ore into steel where you could just do it domestically is beyond me as an idea. It's not. It's not what's going to happen?

Ebony Bennett [00:24:44] Yeah, I can see we've got a couple of trolls on the chat who hopefully that we've removed. If you can just let us know if you spot someone like that and we'll kick them out. Thanks very much, everyone. I can see we've got 1200 people on the line with us. Huge interest in this book. The big switch from so Griffith at an all good bookstores at the moment. So I did want to ask you next about you've got a chapter about regulation and the role of government and why politicians and regulations matter here at the Australia Institute of Public Policy think tank. We're obviously very excited about that kind of stuff. What are the things that both federal and state governments can do to really help accelerate this transition?

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Saul Griffith [00:25:30] Really, it's federal, state and local governments. So the easiest way to understand this is fossil fuels have been a great thing for humanity. For a hundred years, they provided us our comfortable lives. It's the reason we, the 20th century, was allowed to happen and we wrote an awful lot of laws that were optimised. These are building codes. These are your transmission

Saul Griffith [00:25:52] rules, et cetera, around a fossil fuel universe. A lot of those rules, including subsidies, for example, for fossil fuel production and our handy, are advantaging the incumbent fossil fuels in their handicapping the upstart, which is clean electrification with renewables. If you just said, how do we how do we fix this as fast as possible, you would start to with a policy starting from federal down state through building codes and local and zoning codes. How do we make sure that we are optimising all of that regulatory stack to make sure that the future we need is the cheapest it can be? One fabulous example that we got right perhaps by accident in a way that America did not get right, but it really emphasises the example is Australia's rooftop solar programme. We subsidised the market through rebates incentives which helped by the cost down, and we rode that cost falling cost of the solar modules. Until now, they're competitive by themselves. But perhaps even more importantly, we ran a certification and training programme that both trained the workforce and lowered what's called the soft costs, the soft, the cost of terminating installation and inspection the dictate the ultimate price of that electricity. As a result of that, Australia makes rooftop solar at a dollar a watt. In the US, it's \$3 of what? That's the difference between being one third of the cost of the incumbent electricity in Australia and being a little bit more expensive in the US, which is why we have 30 plus per cent of households with solar in the US is struggling to get to two per cent of households. So we need to do clever regulation like that for all of the things that we know are the solutions. So electric vehicles help. Buy down the cost while we're developing the market, helped build capacity, helped build charging network capacity. We need to do all of those things. We need to do the same sort of workforce training for the heat pump and the water heating in the space heating and the electrification of the kitchen and the upgrading of the switchboard so that we have a large enough army of trainees ready to go and and and build this future for us, but also make sure that we're not right now. We handicap the cost of vehicle of household batteries because we require all of these other things like bollards and other mechanisms. Surely we can optimise some of the regulatory environment about that to make batteries cheaper, as we did with solar. So everywhere in the regulatory stack between things that the federal government does, which is subsidies currently for fossil fuels, not for the things that we want true what state governments do, which is often rules of the grid or the local distribution network, which actually is also a federal thing right down to what local governments do. All needs optimisation so that we can make this thing. You know, if we did it perfectly, we might do better than that \$5000 per household and savings if we do it poorly. We may not realise all of those savings or we may be sending that money to the wrong winner.

Ebony Bennett [00:29:03] Saul I want to come back to abundance and painting a picture of what's possible for Australian households. And I was reading Chapter 12, and I think you might have a future as a novelist because it's one of the best descriptions of a person I've had. I'm just going to read it at. Jacko is 74. He likes fishing and after years of working as a dairy farmer and a chicken

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sector, amongst other things, he sold up and moved to the coast. Jacko likes to issue weather reports and his standard unit of measurement. A number of dogs blown off a chain. Jacko is both types of gold, Benson and Hedges, unfiltered and Nescafé. And you talk about the system that he'd set up at home. Tell us a little bit about Jacko and what this looks like for ordinary Australian households this transition.

Saul Griffith [00:29:50] So you've just revealed yourself that you read the whole book because you made it through to Chapter 12 that you didn't read the acknowledgements. So I wrote everything in the book, except for most of the regulations chapter. Dan, who's here to help me write because he's that actual on the ground expert on regulations. That's why I gave you the 30000 foot example in that question, and he knows that on the ground level. But I actually called one of my favourite friends, a woman called Fiona Whitelaw. She lives in Mareeba on the south coast, and she is actually the richest person in Australia. And I said, How would you describe the great things that are happening? And so she wrote the first draught of that story. The character is actually an amalgam of four of her neighbours. And you know, I did some editing on top so I could pretend that I wrote it, but in full credit, you know, she's she's great. I was actually reminded. So she is all, you know, she's a planet saving environmentalist, but she actually was Instagramming from a speedway where she was, you know, watching the Veidt's on the dirt track at the local speedway on the weekend. So she I actually think she represents sort of some of the optimism on Australia. She can have that, you know, we all have that internal conflict. I want to save the world, but I want my coal barbecue, you know, I want to save the world, but I really like my V8. So most of us, Mea Culpa, are still there. And what we were trying to do in this chapter is like, you know, we're still Australians. We still like our Benson and Hedges, sadly. How do you solve climate change with that unique Australianness and the other part of the intent of the chapter, really to say it's already happening because these are things that are really happening in that community? You know, I also mentioned that chapter of my sister, like she's a single mum in Sydney, but she's found that electrifying everything in her life is saving her money. She's not, you know, she's so I. What I'm most encouraged by is that the real characters of real Australia are getting the job done on the ground. You know, the last anecdote to that is I just did a flying to three rural Victoria with Helen Haines. And to paraphrase, you might say that it appears that the Country Women's Association is going to save Australia from climate change and then go on to save the world. It'll come with a side of delicious cucumber sandwiches, but you know, it kind of makes sense. Women seem to understand the future generations are at stake here. They've got less ego involved in how loud their V8 is, and they make 80 per cent of household purchasing decisions. So I like I don't know. I kind of like what I see on the ground in real communities in Australia, and it's I. I think one of the greatest sources for optimism in the world on climate action right now.

Ebony Bennett [00:32:49] Yeah, well, that's very inspiring and certainly the Country Women's Association is a force to be reckoned with on a number of policy fronts, so that's exciting to hear. They're on the case. I'm going to go to questions from the audience very shortly. I can say I was still got 100 people on the line with us. Thanks so much for joining us today. The first question that I've got here is from John Knox, who says electric vehicles are a big piece of the puzzle. Should all electric vehicles be capable of bi directional charging?

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Saul Griffith [00:33:22] In a perfect world. We would have all vehicles capable of bi directional charging or vehicle to grid. The reason why is the largest battery in the future of Australia won't be these grid size batteries won't be these big batteries won't be the community batteries, it'll be the collective battery of our 20 million vehicles. And those 20 million vehicles will be able to backstop the whole Australian grid for five to 10 days. If we're we have that much, that is an extraordinary amount of resiliency that will be built into our vehicles if we enable them to do that by directionality. The more we enable the vehicles to participate in that way, the less are the batteries there need to be in the system and the cheaper the whole system will actually be for Australia. So in some nerdy economic physicist, perfect world sense you'd optimise and you'd dedicate something like 10, 20, 30 per cent. I haven't run the optimisation, I'm guessing, but it is some amount of that battery that would really help the ultimate energy economy. Australia would be best if we were engaging those vehicles,

Ebony Bennett [00:34:33] and I might just point out the Australian Institute just released a really excellent report on the manufacturing opportunities for an electric vehicle market here in Australia that was released by the Carmichael Centre. If you Google Carmichael's centre, you should be able to find that it kind of takes a bit from what Soul was talking about with the opportunities for value adding to our exports, but takes it all the way through to actually making electric vehicles with the batteries that we produce here using the lithium that we we mined here. So check that out. The next question is from Michael Gunter. He this one might be for you as well. Dan, is there any role whatsoever for the consumer and megawatts timed to synchronise with low renewable energy power generation in real time? Do you want to take that one first sol and then I'll go to you, Dan..

Saul Griffith [00:35:21] Absolutely. This could be called megawatts. This could be called demand response. This could just be called smartly using the things that we already have as batteries. So again, if you if all of our hot water heaters were charging themselves during the renewables times, probably the middle of the day, that gives us a discount on the other types of batteries we need to have in the system because they'll be able to provide our hot shot showers in the middle of the night and early the next morning. We can use some amount of their heating systems, also as a battery that are basically a battery that thinks one day ahead uses yesterday's sunshine for tomorrow's heat that will also help us. And there are similar systems such as our fridges, refrigerators and other things where we will be able to get these benefits and our pool pumps absolutely by shifting those loads. And then the other megawatt that you might mean is some efficiency, which is the energy we don't need. If we insulate more with double glazing windows, we should be absolutely doing that on new building stock where it makes sense we should be doing it in retrofits. But it honestly, the good news for Australia is we don't necessarily need all of that efficiency to get the job done. That's the the the abundance aspect of this that might rankle some traditional environmentalists is we can do it with the world's biggest houses and our addiction to automobiles.

Ebony Bennett [00:36:53] Mm-Hmm. Dan, did you want to add anything to that?

Dan Cass [00:36:57] Yeah. Look, I call that and look, one of the things that surprised me is how people are using this distributed battery systems already and in Australia, there's been some great innovation by local engineers building technologies that can do that. So one example is positive energy is started by a trader, in fact. So those benefit in trading energy. And what that system does is the battery is used not only to supply and balance the grid growth energy supply. You know, the megawatts traditionally conceived, but also security and security services seems kind of niche, but it's a big part of the kind of coal propaganda, a big, huge spinning machines that chug away at a certain frequency and that keeps the frequency in the grid stable and the lights stay on, the computers work and everything is synchronised. And in fact, some of the most lucrative use of these distributed batteries now is, is it instantly, almost instantly. I mean, those engineers, I can't say, but almost instantly balancing changes in the voltage and the power in the grid to make sure the distribution network is operating and humming really well. And that's where there's a huge amount of value from distributed batteries because they're down in the grid where everyone else is consuming the energy. So in a way, they're adding much more value to that. They're at the edge where everyone is consuming, not on the big trunk, at the transmission level, which you know is important, but. Probably isn't going to be such a sweet spot for batteries. There's other examples in South Australia. If people saw the fantastic 7.30 story that was in last year, there was an amazing couple with their electric mower in South Australia. They're in social housing that have social housing. A thousand of the social housing households there have been given a free battery and a free solar system and the technology to rig it all up together. And the state government is subsidising this pilot, which is an excellent pilot model for the world, and the government is putting in about 27 per cent of the of the capitals of that project to buy back these resiliency or security services for the distribution network. So I could have built a really big machine, you know, sold that to tell you what kind of thing a second or whatever to keep the distribution network humming. But they found it would be cheaper to just pay for this partial electrification of a thousand homes. And the lovely thing is it's social housing, and everyone who participates from day one had a 20 per cent reduction in bills because I've seen some questions and great questions about who are we leaving behind, what's the equity? And, you know, thank goodness Australia Institute audience is thinking of that. It's not just about the gadgets, it's the people people don't get behind.

Saul Griffith [00:39:41] You just said something that I think is an unbelievably important point, and I know no one probably asked this question, but I want to ask and answer my own question. Australia is the we believe in 20th century infrastructure, it's how everything has always been done here centralise decisions buying giant machinery, public private partnerships, installing those things. And that came to be what defined infrastructure, dams, it's roads, transmission networks. What we need to do as a nation. Instantly is realised that 21st infrastructure is actually our connected cars. It's the infrastructure is parked in the driveway, the infrastructure is in your kitchen, the infrastructure is in your basements, in your garage, it's on the side of the house, it's on the local distribution grid and that you get double bang for the buck when you invest in that infrastructure because you improve the housing stock and you improve the lives of all of the people who own that infrastructure, as well as build this resiliency and build this robust national infrastructure that we all benefit from. So I think we need to get governments at every level to now start saying, Oh, I understand vehicle charging in the homes and electric vehicles as part of the national infrastructure, because if we do that, we start

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to think about economically about how we make this the nation building project that saves every household money and is the type of infrastructure we need.

Ebony Bennett [00:41:13] Yeah. Well, following on from that, the next question I've got here is from Ben Foley. Ben, I'm not sure if you're the Ben Foley I went to high school with, but you've got a great question here. With the increasing residential solar and the reduction in the use of power from the grid, Ben is worried this will lead to increased electricity prices from the grid. Black Angus Taylor has been warning about the last couple of weeks. Is there a defence against the increasing cost of electricity for those who cannot afford to invest in residential solar? So that's a backup on that equity argument.

Saul Griffith [00:41:43] I'd love to answer this one. It is a great question because it lets me answer to the other thing I wanted to talk about anyway. If you electrified just the appliances and the heating systems of our homes, the grid would need to go from 100 per cent today to about 135 or 140 per cent if we electrify one vehicle in the driveway of all of our 10 million homes will need to deliver about 200 per cent the amount of electricity we lay. And if we electrify the 1.7 vehicles in every driveway and all of the housing things, we need about 250 and per cent of the electricity we produce today. You can't produce all of that on our rooftops and in our communities. In New York, it's very reasonable to believe 25 per cent can come from our rooftops, maybe as much as 50 per cent with bigger systems, more efficient solar. We can't do it on the community. We could maybe get another 25 per cent out of the community putting things over parking, parking lots, solar on the church, solar on the life saving club, solar on the RSL. But you still need the grid and you need it to be at least that. And the big energy supplies services out there on the grid like wind farms, solar farms, hydro. And so we're. It's not like we're going to lower the amount of energy that's on that grid. So no. And that cost of that electricity is going to go down because wind and solar now based natural gas and coal and everything city. So you should expect the electricity that comes from our transmission grid to be cheaper because you're putting close to three times as much electricity over our distribution grid per unit of electricity delivered. The distribution grid is going to be much, much cheaper now. And because the rooftop solar is the cheapest electricity generated anywhere in the world, that's delivered to the end consumer. We should also expect that electricity to be cheaper. So. Angus, I don't know you personally, but you're wrong on three counts. Electricity is going to get cheaper, cheaper and cheaper. I mean, we could. And you know, Angus unfortunately, has the keys to the kingdom, so he could design the rules to prevent that windfall for the Australian people. And, you know, looks intent on it. But roughly, that means that our current energy policies are trying to steal money from our households and our communities. And we need we need to look at this as a country and do a better job of designing the system we need this decade in this century.

Ebony Bennett [00:44:24] Mm-Hmm. The next question I've got here is from Meg Evans and a reminder that you can upvote other people's questions. Meg is concerned that you're distilling climate change action to simply replacing fossil fuels with renewables when the real problem is over consumption, and that these renewable energy sources will also need fossil fuels to create the

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panels and wind turbines and cars, etc.. And that's, I guess, Meg's concern. Do you have any response to that?

Saul Griffith [00:44:53] Two answers to Meg. The first is yes. Today, some of the cars are being made with coal natural gas. Some of the solar panels are being made with coal and natural gas, but that's a temporary problem every year. The grid is getting more renewable of new generation supply built out globally. In 2020, 75 per cent was renewable, not Fossil. So every year we go into a future, that's that idea or that statement is less true. And eventually there's a point in the near future, hopefully 10 years, but maybe 20 years out where there's no fossils used in producing our vehicles, no fossils used in producing our solar, et cetera, et cetera, et cetera. So there's one point is it gets better every year. You're right today, but you're less right every subsequent year. The other point is compared to what we do today, 6000 kilograms of fossil fuels are burned for every living Australian every year. Today, that's our, you know, that's our annual consumption of coal, natural gas and petrol. If we were to supply the same Australian quality of life, same sized vehicles, same sized home, same leaky, not efficient, not double glazed homes, we would only need we'd need less than half of the energy if we produced it half with solar, half with wind, and we still had half of it in batteries. You'd need round figures. Twenty five kilograms of wind farms per person per year, twenty five kilograms of solar per person per year, and 25 kilograms of batteries per person per year. But remember, most of the things that those things are made out of are metals. Most of them are very, very highly recyclable. The most recycled things in the world are steel and aluminium today. And so in fact, we're this is the template for a circular economy where maybe 10 to 20 kilograms of stuff per person per year is being pulled out of the ground as opposed to what we do today, which is 6000 kilograms that we just sent straight into the atmosphere and it becomes 20000 kilograms of carbon dioxide. So I think there's a lot of room for optimism here.

Ebony Bennett [00:47:03] Yeah, I can see a couple of questions in here about other environmental problems such as recycling, all the waste and all the obsolete appliances and things like that. You do address in a chapter there Chapter 11, I think so long and don't kill all the fish. That climate change obviously isn't the only environmental problem facing the country, so I would encourage people again to buy the book and check it out. It's very comprehensive read, but I did want to get back this. Just a number of questions that I can see in here that just want to know more about hydrogen and why discount hydrogen? I've got one from Phil Dey here who says we're going to have excess energy in summer. Why wouldn't we use that to make hydrogen to generate electricity when generation is not sufficient? And there's a couple of other people on the same theme worried that you've discounted hydrogen too soon. Could you recap for us why you think we're putting too much store in there?

Saul Griffith [00:48:03] If you read the book Shameless Plug, which is an electricity joke, by the way, the shameless plug, the. It's an incredibly intelligent question, and in fact, it's exactly the way to think about what portion of the economy will be hydrogen based at some point we will be so abundant in our generation that we don't have any other use for it, and that will mostly be in the summer. And then why don't we use that to make hydrogen and for export or storing it away or et

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cetera? And we will for sure do some of that. And then maybe that ups your estimate of how much hydrogen will be in the economy by one or two or five percent up to 10 percent, maybe 20. There is one weakness with that argument, though, is the cost of hydrogen is very, very sensitive to the capital. Cost is very, very sensitive to the operational uptime. So there's no electrolyser that wants to run 50 per cent of the time. They need to be run at 100 percent in time to make their economics work. There's no compressor that wants to run 50 per at a time that increases the costs of the tempering effect on this good idea will be low utilisation in the equipment. So maybe we have to bring a jetpack down closer to five percent. I'm not antihydrogen. In fact, I developed hydrogen tanks that I sold to a consortium of the world's auto companies. So if you buy a Toyota or Chrysler, Porsche and Audi that has a hydrogen tank in it, that's technology that I built. I will do very well if hydrogen is a winner. But as an insider who knows the molecule, who knows the tanks, who knows the compressors intimately, I can say it's we need to temper our into chasms.

Ebony Bennett [00:49:57] Dan, a quick one for you here from Neil McIntire. How much work will be involved in model modernising the Australian electricity grid to support the pivot to renewables?

Dan Cass [00:50:08] Right, so technically and if the rule change level, but can I just Segway back briefly to the question that so got about the how to soak up all the excess solar and wind ammo does the modelling for the country about the Integrated System Plan, so the cheapest and best way to get to allow coal to retire over the coming, however long it is that government is allowed to happen and consistently they publish the the results that the new draught is out at the moment to 2022. There's an increasing amount of spill or waste or curtailment of solar and wind as you get greater penetration. It never tips into territory where it requires you to somehow capture them. So they've done the modelling and looked at how much can be wasted, and you can utilise things in large scale generation less and less as you build out the grid. It's still the cheapest form of energy. There is still no coming back to the fossils, but also no need to then build with sources very capital and expense capital intensive hydrogen infrastructure that you would run for a small percentage of the year just to soak up that value. So people shouldn't worry about the idea in this era of abundance that the wind farms and the solar farms will be wasting energy for some of the year. That's that's been accounted for. It's part of a model. So that's the good. The good question. How much work is needed? Look really a hell of a lot. But the good thing is that states and territories are already doing it. So shameless plug two. If you've read the book, I agree with so entirely that the states and the territories, including a city, are doing a great job of coming up with programmes and pilots and rule changes themselves to progress things. But it's a mammoth task, and I was involved with the Energy Security Board project to redesign the market for 2025, and it was really underwhelming. I mean, that design is now kind of in process and being approved by governments, and the new design in 2025 will not unleash electrification. It will hold it back. It will hold back vehicle to grid charging. It will hold back the scale of solar build out at the distribution level. People will not be able to supersize their systems. It won't encourage the batteries to be at the optimum place that solar has worked out is it is partly, you know, the big transformers on every exposing your distribution network. It will really push the storage, run out onto the transmission backbones and renewable energies. So there is actually a blitz of regulatory work to be done. Whoever wins the next federal government should take it on because the regulatory work is almost free doesn't

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mean building backbones and generators and undersea cables. It means paying some smart people sit down from the law and the engineering sides and work out what is the rule book to give us what the name? You know, grandpa and grandma said, we need it in 1992, when I was watching sort for the first time, just equal opportunity. You know, this is really all we need. In a nutshell, the grid should give equal opportunity to the electrons coming out of Soul's Electric Monaro and the electrons coming off a rooftop solar and the electrons coming out of any existing demand response systems that the Teslas and the Queensland governments and whoever else builds. And if they're equally able to compete against gas and coal, that will lower the price for everyone because competition does that and it will push the fossils off quicker. So it's almost a climate policy for governments who just want to talk the hip pocket so reform can't get enough.

Ebony Bennett [00:53:46] The next question and is from Fran Lee, who says, So how do you convince those in coal country that there will be jobs for them? Research shows that people don't believe the facts about coal. Do you have any response to that then?

Saul Griffith [00:54:07] I think you've got to sit down with them and be a real human being and do it over a beer at the kitchen table, and I think we are the way because too many people are complicit in shouting over their lattes, and I do believe that criticism is fair. I do worry that. Someone says shut down coal plant and then the community thinks that's tomorrow. None of these things that are tomorrow in reality, I would absolutely trade another year or two of coal here and there in a steady transition down over the next 15 years. While we wind up all of the demand side electrification have to produce it. And it's really, you know, it's a 20 year timeframe. And if you think about it, I think the communication should be. Look, it's not about your job disappearing tomorrow. There'll be a steady winding down of this industry at roughly the rate which which people retire from this industry already. And it's not about you losing your job so much as train your daughter to be an electrician instead of a coal miner. In terms of the regions, the regions really do win. For Australia, it will be with the industrial solar. Industrial wind is being produced. There's going to be a huge number of jobs that more per kilowatt hour than there is coal. There'll be, you know, there's this lovely term electro agriculture or renewable agriculture now where you're you're putting these solar and wind farms in concert with the agriculture. It has mutual benefits. Sheep grazing under solar panels. Turns out, it looks like it may have higher productivity than sheep that are exposed purely to the harsh Australian sunlight. So, you know, I think we have to be enormously sympathetic to these communities. Not every community will win immediately. We should have really generous transition plans. I'd like an approach that says, You know what? Thank you for your century of service coal community. You made this country amazing. You made this country great. We're going to be very generous in helping you wind down what you're doing now and wind up a less damaging to your local environment, less damaging to the planet and more profitable industry for yourself as just the guiding principle that should be our philosophy and our approach. And we definitely need to start telling the good news, stories and even planning where we're going to locate our manufacturing and processing industries so that we are making sure that the abundance of jobs that are going to be created from this transition, an abundant share is going to those communities affected.

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Ebony Bennett [00:56:44] Hmm. And again, I think that Carmichael Centre report that I was referring to earlier mentioned that same thing that a lot of the opportunities there in manufacturing will go to regional communities as well. But those are all good points, two quick ones. A couple of people asking here whether the book will become an audio book Soul. I'm not sure if you've got any word on that or any plans on that front.

Saul Griffith [00:57:09] It's funny. One of the last meetings I had in America before I relocated to Australia just at the end of last year, was actually with Sam Walton's grandson and or son. And he said, You know what? I just listened to your book *Electrify* as an audio tape, and it was great. Except the graphs are terrible, and I have a lot of graphs in the book, so it was really interesting to me to learn that now roughly half of people buy their books as audio books that I've got to start thinking about how to narrate the data and narrate the tables and narrate the graphs. So I'd be happy to read this book and send you a cassette tape, but I'm told that the bits with the graphs in it won't translate. That said, we might do a bunch of short videos and put those on the web. If the publisher would like to make an audio tape, I'd you know, I would loan my voice, but I suspect they'd want someone with a better voice than me for reading it. If anyone out there wants to do it themselves, go for it. I encourage it.

Ebony Bennett [00:58:13] Excellent. And just lastly, we've only got a couple of minutes left. So what's the big takeaway that you want people to take away from this and head out to the closest bookstore to buy the book?

Saul Griffith [00:58:26] I'd love you to go out to your closest bookstore and buy the book, but what I really want you to do is take that book, engage with the community. Engage with your politicians. I don't care who you're voting for. As long as you're making them the most aspirational party in the country on this issue, it should be a race to the top in Australia. This is no liberal National Party water heater vs. Labor water heater or greens water heater. They're just water heaters. They don't care about the politics, and they'll all be cheaper when they're electric and powered by renewables. And why shouldn't Australian politics be around what we have to win and the economic benefits? So really, that's the take home we need in a hurry to change the narrative to what we have to win and the abundance agenda and. As soon as we've won that and we've got all three parties chasing the ball because so many people want the abundance agenda, then we need to start organising in our communities so that every community. Has a plan for how they're going to reap the rewards of doing this as fast as possible. You know, go going, go and become your local country women's association member or the equivalent Inner-City City Community Group. And let's let's get the job done because you know, this can't be stated enough. This is the gift that Australia has to give to the world for as. Recompense for our 30 years of dragging the chain on climate and looking like a petro state, we can now go first, go hardest, show the world how to do it and I can't under estimate or can't understate this enough. If we do that, America will follow, Europe will follow, everybody in the world is waiting for the same for a good news story is probably why half of you signed up for this podcast. It's it's for. We need some optimism, some good news stories and that's what Australia has

to give to the world. So, you know, get your kids to read the book, get your mom to read the book and then get out there and make both parties chase the ball here.

Ebony Bennett [01:00:38] Yeah. Thank you very much for ending on that note of optimism. I'd like to echo it. The book is a really easy read and left me feeling very hopeful, which is so unusual in climate change policies and politics. It's a big switch. Thank you. So Griffith. Thanks, Dan. Cass, and thank you everyone for your fantastic questions. I'm so sorry. We can't get to all of them. Head on over to Australia Institute dot org. Don't you just sign up for next week's webinar, which is with Alan Bain, the head of our international and Security Affairs programme. We'll be talking about his new book *No Friends, No Enemies, No Friends Restoring Australia's Global Relevance*. Thank you again for joining us today. Don't forget to subscribe to our podcast. Follow the money! And this will be going up as a podcast episode later this week. Thank you again, everyone, and hopefully see you again soon. Take care out there and we'll see you next time. Buy the book!